MISCELLANEOUS.

Researches on the Structure, Organization, and Classification of the Fossil Reptilia.—Part IX. Section 5. *On the Cynodontia.* By H. G. Seeley, F.R.S.

The Cynodontia is a division of the Theriodontia in which there are long and large temporal vacuities in the skull, formed chiefly by the squamosal and malar bones; in which there is no descending pedicle to the squamosal bone; in which the occipital condyle is crescentic and imperfectly divided into two lateral parts; and in which the hinder molar teeth, larger than the incisor teeth, develop anterior and posterior cusps, are compressed from side to side, and overlap with shear-like action the teeth of the mandible. The principal new genera included in this group are *Cynognathus*, which is known from several skulls and one fairly complete skeleton, and the genus *Tribolodon*, which does not differ in a striking way from the small Cynodonts previously known, referred to the genera *Galesaurus*, *Nythosaurus*, and *Thrinaxodon*.

The skeleton of *Cynognathus crateronotus* was found at Lady Frere, near Queenstown. A single tooth of this genus had already been obtained by Mr. Alfred Brown at Aliwal North. The skull is between 15 and 16 inches long, 8 inches high at the orbits, and higher at the occiput, where it was about 9 inches wide. The lateral aspect is remarkably mammalian, owing to the great development of the dentary bone, which forms a new type of lower jaw, and has a greatly developed coronoid process, and to the form of the zygoma. On the palate the palatine and transverse bones form a descending arch between the rami of the mandible, as in crocodiles, *Sphenodon*, and Lizards. The composite structure of the lower jaw is seen on its inner side. The prefrontal and postfrontal bones remain distinct. There is a small quadrate bone embedded in the large squamosal bone. The latter resembles that of mammals, both in its extension along the zygoma and its expansion as a squamous plate on the side of the brain-case.

There are four incisors in each premaxillary; their margins are serrated. There appear to be but three mandibular incisors on each side, so that the type resembles *Cynochampsa*; but there is no evidence of close affinity with that genus. The canine teeth are large, worn on the anterior border, and serrated on the hinder margin. Remnants of canine teeth are indicated which have been replaced by those which persist. There are nine molar teeth, of which the first five are smaller than the posterior teeth. Those teeth are more than half as wide again from front to back as the anterior teeth. The hinder teeth have the principal cusp directed backward, with one subordinate pointed cusp on the front margin and two subordinate cusps on the hinder margin. The crowns of the teeth stand high above the alveolar margin in this species. They are intermediate in form of crown between *Canis* and *Zeuglodon*.

The nares are terminal, divided, lateral, and arch forward in front of the alveolar margin. The orbit of the eye is 8 inches behind the extremity of the snout, nearly circular, and separated from the temporal vacuity by the postfrontal bone. The postfrontal bones converge backward along the parietal crest. The malar bone develops a slight descending process on its inferior margin. There is no interorbital septum ossified. The type species of *Cynognathus* shows on the one side preserved a small postorbital foramen, comparable to that of *Procolophon*, and the author considers that the enlargement of this foramen makes an essential difference in plan between the skulls of Teleosaurs and Theriodonts, and regards the mammalian zygoma as resulting from the obliteration of the postorbital vacuity which defines the superior and inferior temporal arcades in Saurischia and other Reptilia.

In general structure of palate *Cynognathus* resembles *Lycosaurus*. There is no transverse boundary to the hard palate, but the palatonares are lanceolate. The author finds that the downward development of the bones of the palate at the posterior borders of the nares, while thoroughly reptilian, approximates to the condition in mammals.

The form of the lower jaw approximates to that of the older mammals and lower mammalian types, leading to the conclusion that the mammalian lower jaw consists essentially of the dentary bone. The dentary bone is compared to that of *Micronodon* in form and development of the angle of the jaw.

The shoulder-girdle consists of a large scapula, small coracoid, and compressed pre-coracoid. The scapula demonstrates the origin of a spine like that of the scapula in mammals by outward development of the anterior border of the scapula in reptiles. This spine is defined by a prescapular development anteriorly. The spine may have been originally a separate ossification, such as in *Pareiasaurus* has been named epiclavicle. It terminates in an acromion which is reflected forward.

The humerus is imperfectly preserved, but has the distal condyles well developed; and the proximal crest has a form which is seen in marsupials, but the articular head is transverse.

The vertebral column measures 37 inches from the body of the atlas to the last lumbar vertebra, and its total length is 45 inches; but the extremity of the tail is lost. There appear to be only six cervicals defined by the form and direction of the transverse processes for the tubercles of the ribs. The head of the rib is attached to the intercentral suture, and in the first vertebra reaches the intercentrum. There are 29 presacral vertebræ, of which 18 may be counted as dorsal and 5 as lumbar. The most distinctive feature of the vertebral column is the interlocking of the ribs in the lower dorsal and lumbar region, where the ribs become transversely expanded and anchylosed to the side of the centrum. The neural arch in the lumbar region also interlocks by an arrangement resembling the zygosphene and zygantrum of serpents. No dorsal rib is completely preserved.

The sacrum is small and the sacral ribs are smaller than the lumbar ribs. They are four in number. The middle two vertebræ are anchylosed. The caudal vertebræ are short, only four are preserved; they indicate a considerable movement. There is no evidence of dermal armour. The characters of the vertebral column described by Professor Cope in *Dimetrodon* and allied genera closely resemble *Cynognathus*.

The pelvis consists of three bones; the ilium forms an expanded plate more resembling *Megalosaurus* than *Dicynodon*. There is a large longitudinal obturator foramen between the pubis and the ischium. The anterior transverse border of the pubis is cartilaginous, and there is no evidence of pre-pubic bones. The ischium is larger than the pubis. The author compares the anomodont pelvis with that of Plesiosauria, although *Pliosaurus* in the form of the ilium more closely approaches *Dicynodon* than *Cynognathus*.

The femur is imperfectly preserved. It was characterized, as in all Theriodonts known to the author, by the development of an immense inferior plate or ridge at the proximal end, which distinguishes it from allied animals. In this specimen the ridge is broken away. The head of the bone is greatly expanded transversely, and the distal end is not preserved.

Under the name *Cynognathus Berryi* the author describes imperfect evidence of a smaller skull of *Cynognathus*, which is distinguished from *C. crateronotus* with some doubt; but, if distinct, it is defined by the relatively large size of the middle mandibular incisor, the apparent presence of ten molars, in all of which the crowns overlap each other, and the roots are barely shown at the alveolar border. In the small species the cutting-margin and the cusps of the posterior teeth are better defined.

If the species are identical, the teeth have probably yet to be replaced by a successional series; but no known specimen of any genus shows such replacement.

The skull of *Cynognathus platyceps* was obtained by Dr. Kannemeyr at Wonderboom. It is a small species distinct from *Cynognathus crateronotus*. The skull has lost the extremity of the snout. It is remarkable for its depression. The teeth, however, are similar to those of the larger species; they have five denticles. The composite structure of the lower jaw is well shown, and the dentary bone behind the angle of the jaw retreats, so as to expose the elements which form the articulation.

The occipital plate of a large Theriodont skull from Lady Frere is described, which shows a circular foramen magnum and the perfectly preserved occipital condyles, which are not quite so completely separated as in mammals, having only a median groove between them on the ventral surface.

Another fragment of a skull preserved in the Albany Museum has only the preorbital portion preserved, and is remarkable for the small size of its incisor teeth, widely separated from each other, and for having two canine teeth parallel to each other. On both sides the crowns are imperfectly preserved. The molar teeth are on the

type of *Cynognathus*, with a principal cusp flanked back and front by a small cusp, with a smaller accessory posterior cusp in the four hindermost teeth. As in all species of the genus the mandibular symphysis is long, oblique, and completely obliterated. There is a large pit with sharp margin in the median line in front of the orbits, which may be a generic difference from *Cynognathus*, since it occurs in the area in which other specimens show indications of a thin supra-nasal ossification flanked by a pair of small hemispherical concavities. It is indicated as *C. leptorhinus*.

Tribolodon frerensis is the name given to a dentary bone with few three-pronged teeth widely separated from each other standing high above the jaw. With this jaw is associated a femur which shows the transverse development of the great trochanter as strongly developed at the proximal end of the bone as in *Ichthyosaurus*, so that the trochanter minor of mammals only represents that of Theriodonts in miniature, the trochanter being more developed than in Saurischia or any other reptiles. With it is associated a right tibia, which is somewhat curved and nearly as long as the femur.

These Cynodont remains have given no certain evidence of the extremities of the limbs; but, with this exception, they make known the entire skeleton for the first time in an African Theriodont, furnishing data for comparison with mammals and reptiles in every part of the skeleton preserved.—*From the Proceedings of the Royal Society.* (Communicated by the Author.)

The Faunal Regions of Australia. By C. Hedley, F.L.S.

The discrimination of the various provinces into which the Australian fauna and flora group themselves has been frequently attempted. To the earlier naturalists, from a study of scanty material and with little or no personal knowledge of the continent, four divisions of east and west, temperate and tropical, seemed natural and sufficient. Hooker's 'Essay on the Australian Flora' paved the way for a better understanding of the relations which various localities bore to each other. Owing to fundamental errors of his interpretation of Australian geology, Wallace's treatment of the subject in 'Island Life' is of but slight value. To the writer, the most successful arrangement of the various biological regions yet proposed is that sketched by Professor Tate, in his address to the first meeting of this Association. This author accepts two main biological divisions—the *Autochthonian*, developed in west Australia, and the *Euronotian*, seated in eastern Australia and Tasmania; a subsidiary division, less in value and derivable from both the above, is the *Eremian*, or desert fauna and flora.

Taking this disposition as the basis of my remarks, I would observe that eastern Australia contains two distinct biological populations, where Professor Tate has located one—the *Euronotian*. This title, I propose, should be reserved for that fauna and flora characteristic of Tasmania, Victoria, and southern New South Wales; while the second and very distinct fauna and flora developed on the